

Albrecht **Service Manual**

AE-540

2-METER AMATEUR FM MOBILE TRANSCEIVER

CONTENTS

| | Page |
|---|-------------|
| Specifications..... | 2 |
| Disassembly Instructions..... | 4 |
| Block Diagram..... | 5 |
| Alignment and Adjustment..... | 6 |
| Troubleshooting..... | 11 |
| Printed Circuit Boards..... | 13 |
| Exploded View..... | 17 |
| Exploded View Parts List..... | 18 |
| Electrical Parts List..... | 21 |
| Voltage Chart..... | 33 |
| Semiconductor Lead Identification and IC Internal Diagrams..... | 39 |
| Schematic Diagram..... | 46 |

SPECIFICATIONS

General

| | |
|----------------------------|---|
| Frequency Resolution | 5, 10, 12.5, 15, 20, 25 KHz STEP |
| Frequency Range | TX 144.00~148.000 MHz, RX 136.00~174.00 MHz |
| Semiconductors | 33 Transistors, 30 Diodes, 10 ICs, 3 FET, 1 LCD |
| Crystals | 3 Crystals |
| Microphone | Built-in Electric Condenser Type with FET Amplifier |
| Speaker | 8 ohm 3W |
| Antenna Connector | M Type |
| Dimensions(WHD) | 5-4/34"x 1-3/8"x 5-33/64"Inches (130 x 35 x 140)mm |
| Accessories | DC Power Cord With in-line fuse, Microphone Hanger, Mounting Bracket |
| Weight..... | 1.54 lbs (0.78 Kg) |

Measurement Conditions (90% Population)

| | |
|------------------------------------|--------------------------|
| Power Source | 13.8V (DC) |
| Antenna Impedance | 50 ohm |
| Test Temperature | 77°F (25°C) |
| FM Modulation Frequency | 1kHz |
| Min. Signal Input Level | 24mV |
| Reference Audio Output Power | 0.5W |
| Reference FM Modulation | 3 KHz Deviation at 1 KHz |
| Audio Output Load | 8 ohm resistive |

Transmitter Section

| Description | Unit | Normal | Limit |
|--|------|-------------|-------------|
| Frequency tolerance | % | ± 0.005 | ± 0.001 |
| RF power output | | | |
| 13.8V DC | | | |
| HI | W | 25 | 20 |
| LOW | W | 10 | 8 |
| Maximum deviation | KHz | 4.0 | 3.0~5.0 |
| Distortion Mic at 1.5 KHz deviation | % | 3 | 6 |
| Microphone sensitivity | mV | 3 | 10 |
| CTCSS Tone deviation (88.5) | KHz | 0.7 | 0.4~1.2 KHz |
| Current drain | | | |
| 13.8V DC | | | |
| HI Power | A | 5.0 | 7.5 |
| LOW Power | A | 3.0 | 5.0 |
| Mod frequency response (450 Hz) | dB | -7 | -7 |
| (2.5 KHz) | dB | +3 | +3 \pm 12 |
| Hum & noise ratio (1.5 KHz DEV) | dB | 35 | 30 |
| Adjacent channel power (± 25 KHz) | dB | 65 | 60 |

Receiver Section

Intermediate Frequency

1st IF = 21.4 MHz 2nd IF = 455 KHz

| Description | Unit | Normal | Limit |
|---|------|--------|--------------|
| Maximum sensitivity 12 dB SINAD | dBuV | -14 | -10 |
| Squelch sensitivity | | | |
| Threshold | dBuV | -20 | ± 10 |
| Tight | dBuV | -9 | ± 10 |
| Hum and Noise | dB | 40 | 35 |
| Distortion at 1mV input, 3 KHz modulation | % | 2 | 10 |
| Max Audio power at 8 ohms | W | 3.4 | 2.5 |
| Audio output power at 10% THD | W | 2.5 | 2.0 |
| Audio fidelity | | | |
| 400 Hz | dB | +5 | +5 \pm 6 |
| 2500 Hz | dB | -16 | -16 \pm 10 |
| S meter sensitivity at "9" | dB | 9 | +9 \pm 6 |
| Audio frequency response (6 dB/oct) | dB | 6 | +2 to -8 |
| 1/2 IF rejection ratio | dB | 65 | 60 |
| Image rejection ratio | dB | 65 | 60 |
| IF rejection ratio | dB | 90 | 60 |
| Adjacent channel selectivity (25 KHz) | dB | 55 | 50 |
| Acceptance ratio displacement | KHz | 2.5 | 2.0 |
| Oscillator dropout voltage | V | 10.2 | 12 |
| Current drain | | | |
| No signal (Squelch) | mA | 300 | 600 |
| Current drain at maximum signal | mA | 600 | 750 |

DISASSEMBLY INSTRUCTIONS

■ To remove the Top and Bottom Cover (Figure 1)

- Remove two mounting screws (A).
- Remove four screws (B) from each side of the top and bottom covers.

■ To remove the Front panel Assembly (Figures 2,3 and 4)

- Remove ring nut (C).
- Remove one knobs (D).
- Remove four screws (E) from each side. Pull the front panel.

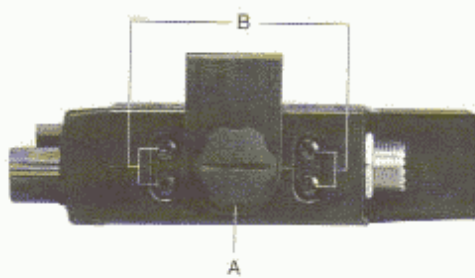


Figure 1

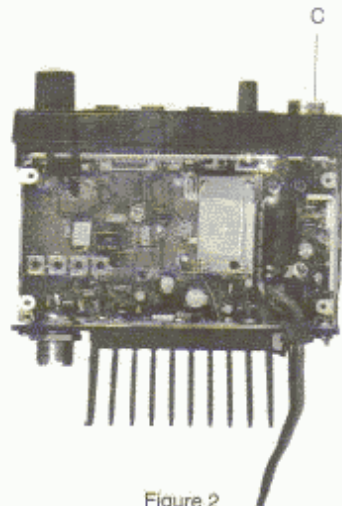


Figure 2



Figure 3

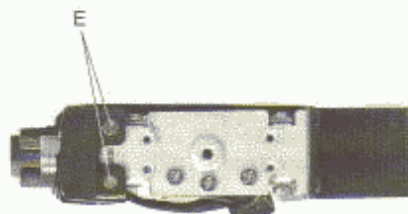
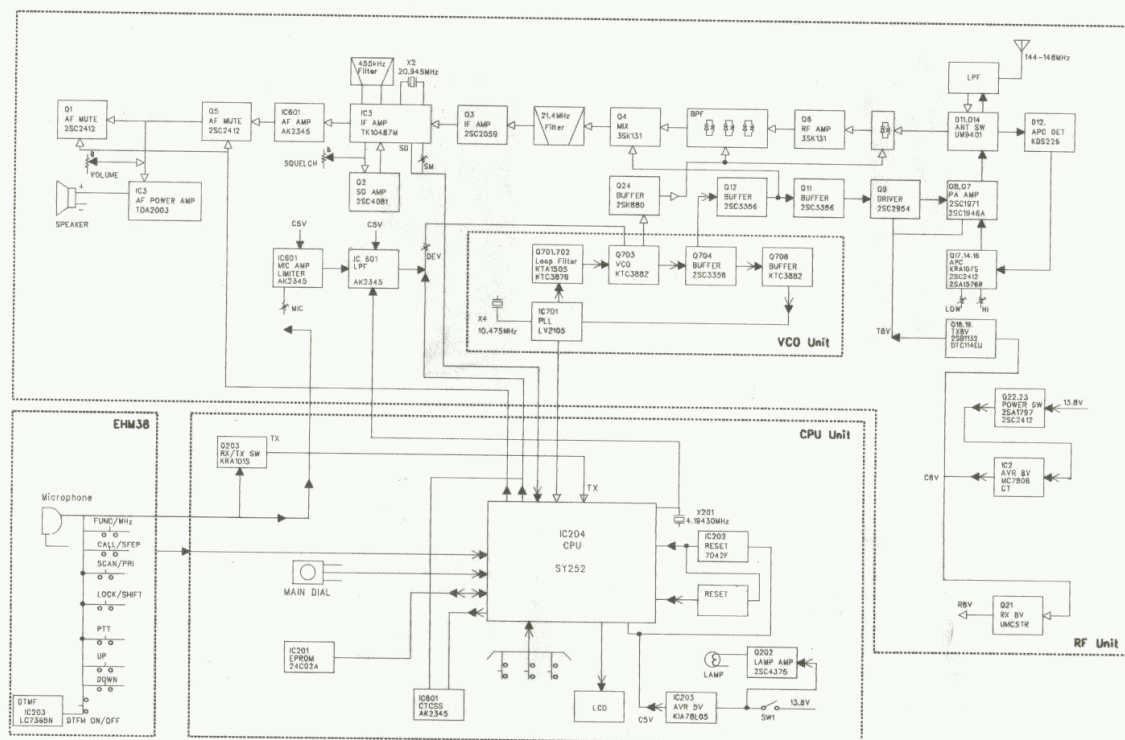
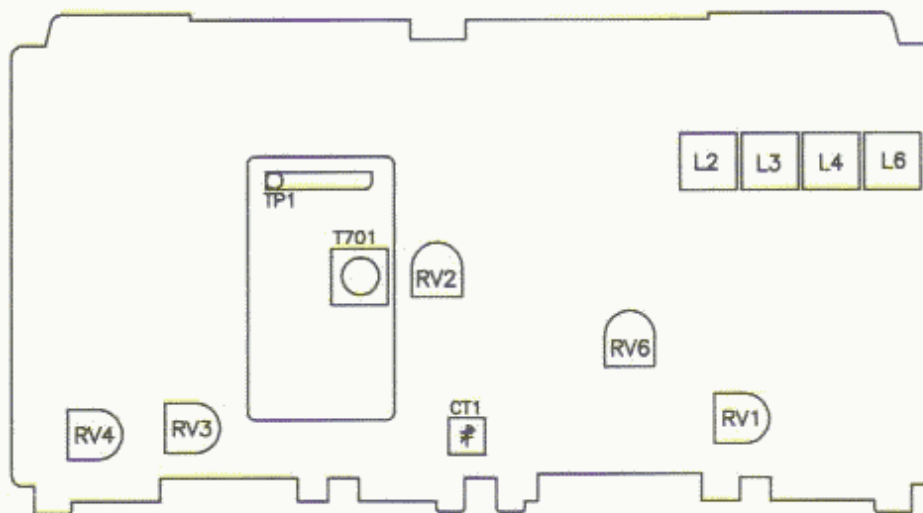


Figure 4



ALIGNMENT AND ADJUSTMENT



Alignment Parts Locations

Required Test Equipment

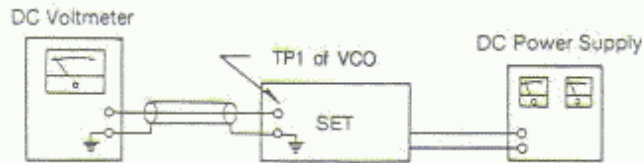
1. **Digital Multimeter**
Voltage Range : FS = 18V
Input Resistance : 1M Ω or MORE
2. **Regulated Power Supply**
Supply Voltage : 13.80V
Current : 10A or MORE
3. **Oscilloscope**
Measurable Frequency : DC to 200MHz
4. **Spectrum Analyzer**
Measuring Range : UP to 2GHz MORE
5. **Tracking Generator**
Output Frequency : UP to 2GHz MORE
6. **Audio Dummy Load**
Impedance : 8 Ω
Dissipation : 5W or MORE
7. **SSG**
Output Frequency : 1GHz or MORE
Output Level : -20dB/0.1 μ V to
Modulation : FM
8. **Frequency Counter**
Measurable Frequency : UP to 200MHz
Measurement Stability : 0.2 PPM
9. **RF Powerency Counter**
Measurable Frequency : UP to 200MHz
Impedance : 50 Ω
Measure Range : Full Scale of 35W
10. **Audio Volt Meter**
Measurable Frequency : 50Hz to 10KHz
Sensitivity : 1mV~10VRE
11. **Distortion Meter**
Measurable Frequency : 1KHz
12. **Audio Generator**
Output Frequency : 50Hz and 1KHz
Output Impedance : 600 Ω Unbalanced
13. **Linear Detector**
Measurable Frequency : Up to 500MHz
Characteristics : Flat 120dB/1V
CN : 60dB or MORE
14. **RF Attenuater**
Impedance : 50 Ω
Dissipation : 50W or MORE
15. **RF Dummy Load**
Impedance : 50 Ω

PLL Section

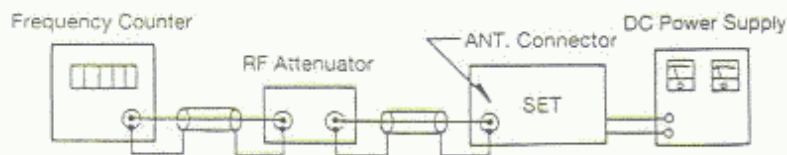
■ Test Equipment Required:

- Frequency Counter :
- RF Attenuator
- DC Power Supply
- DC Voltmeter

■ Test Equipment Connection



(Figure 1)



(Figure 2)

Alignment Procedure

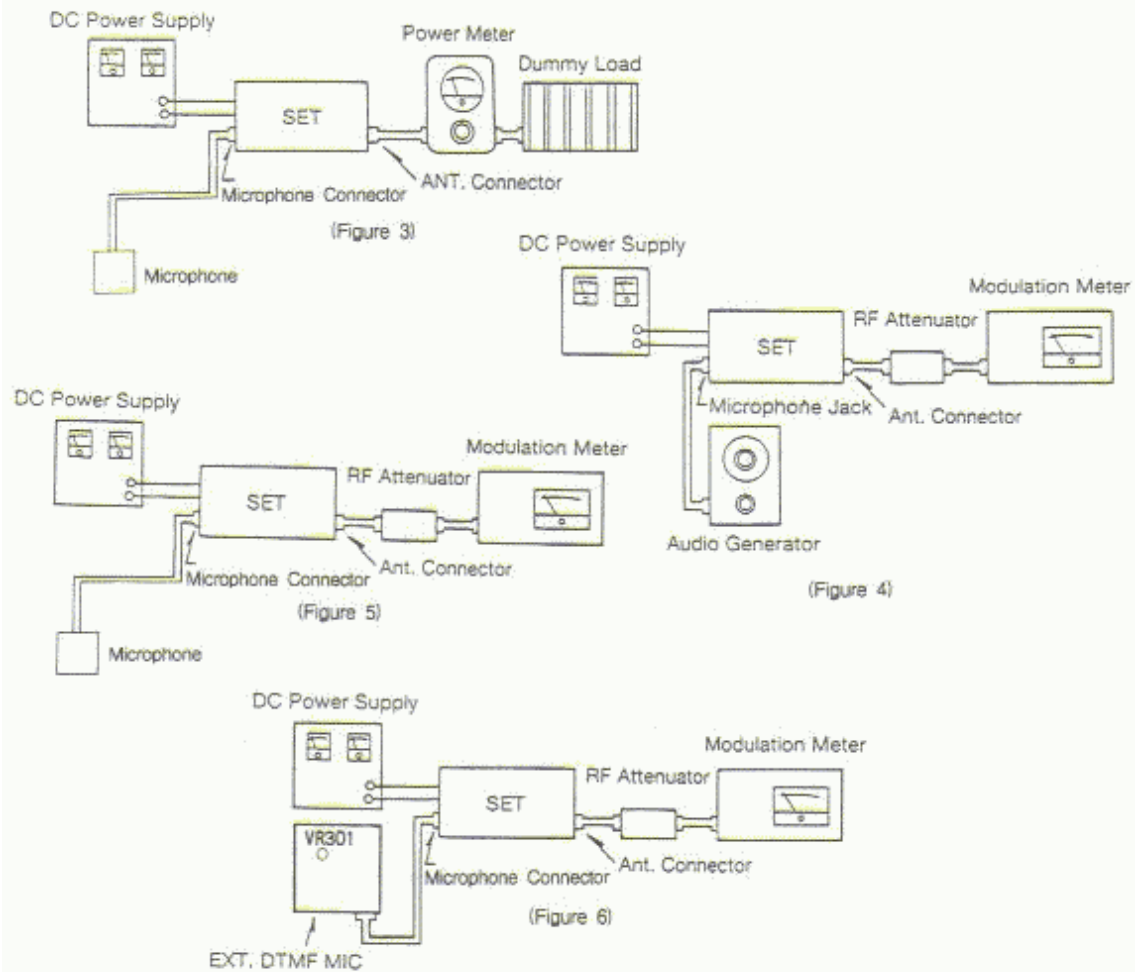
| Step | Setting | Connection | Adjust | Adjust For |
|------|---|---|----------|------------------|
| 1 | VCO Voltage Adjustment Frequency : 136.00 MHz MIC : Receive Volume : Optional Squelch : Optional | DC Voltmeter To TP1 (Figure 1) | TP1(VCO) | 0.6V ~ 0.9V (DC) |
| 2 | Frequency Adjustment Frequency : 146.520 MHz MIC : Transmit (NO Mode) Function : None Volume : Optional Squelch : Optional | Antenna to Frequency Counter Through RF Attenuator (Figure 2) | CT1 | Within 500 Hz |

Transmitter Section

■ Equipment Required

- RF Power Meter
- RF Attenuator
- Audio Generator
- Spectrum Analyzer
- Coupler
- 50 Ω Dummy Load
- Oscilloscope
- DC Power Supply
- Frequency Counter
- Modulation Meter (FM)

■ Test Equipment Connection



Alignment Procedure

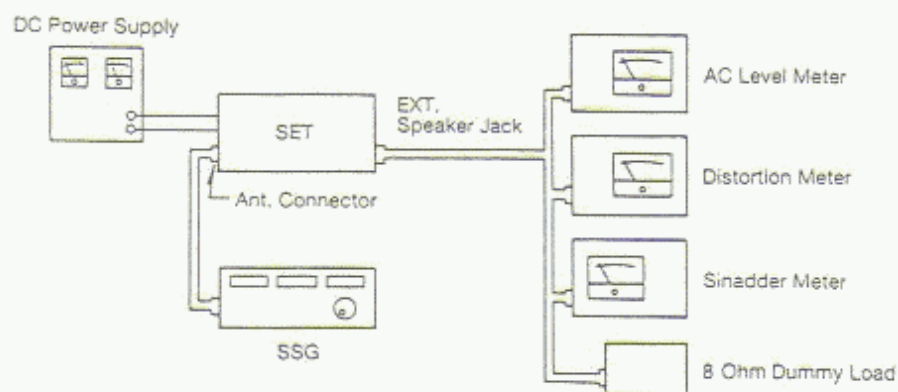
| Step | Setting | Connection | Adjust | Adjust For |
|------|--|--|--------|------------------------|
| 1 | RF High Power Adjustment Frequency : 146.520MHz MIC : Transmit Function : None Volume : Optional Squelch : Optional RF Power Selection : High | Connect Microphone. Connect the Dummy Load to Antenna Connector on the Set through RF Power Meter. (Figure 3) | RV3 | 25W (20W~30W) |
| 2 | RF Low Power Adjustment Frequency : 146.520MHz MIC : Transmit Function : None Volume : Optional Squelch : Optional RF Power Selection : Low | Connect Microphone. Connect the Dummy Load to Antenna Connector on the Set through RF Power Meter. (Figure 3) | RV4 | 10W (8.0~12W) |
| 3 | AF Modulation Adjustment Frequency :146.520MHz MIC : Transmit Function : None Volume : Optional Squelch : Optional RF Power Section : Low | Connect the Audio Generator (Set to 1KHz) to the Microphone Connector. Connect the Modulation Meter Through the RF Antenna Connector. Adjust the audio Signal Level to Obtain 3KHz Deviation. When You Increase the Audio Signal by 20dB, the Deviation Should not Exceed 5KHz Deviation (Figure 4) | RV2 | 4.0KHz (3.0~5KHz) |
| 4 | CTCSS Modulation Adjustment Frequency : 146.520MHz MIC : Transmit Function : CTCSS Mode (CTCSS : 88.5Hz) Volume : Optional Squelch : Optional RF Power Selection : Low | Connect Microphone. Connect Modulation Meter through RF Attenuator. Connect RF Power Meter to Antenna Connector on the Set (Figure 5) | RV6 | 0.8KHz (0.5~1.2KHz) |
| 5 | DTMF Modulation Adjustment Frequency : 146.520MHz MIC : Transmit Function : MIC DTMF Mode Volume : Optional Squelch : Optional RF Power Selection : Low | Connect the EXT. DTMF MIC to Microphone Connector. Connect Modulation Meter through RF Attenuator to Antenna Connector. (Figure 6) | VR301 | 3.5KHz (2.0~4KHz) |

Receiver Section

■ **Equipment Required:**

- Standard Signal Generator (SSG)
- Distortion Meter
- 12dB Sinadder (Signal-Noise Adder Meter)
- AC Level Meter
- DC Power Supply

■ Test Equipment Connection



(Figure 7)

■ Alignment Procedure

| Step | Setting | Connection | Adjust | Adjust For |
|------|---|--|----------------------|---|
| 1 | RX Sensitivity Adjustment Frequency:136.00 ~ 174.000 MHz MIC : Receive Function : None Volume : Adjust for 1V on Squelch : Turn Fully Counterclockwise SSG : Audio 1KHz Modulation 3KHz DEV | Connect Standard Signal Generator to EXT Antenna Jack. Connect AC Volt Level Meter, Distortion Meter, and Sinadder Meter Across EXT Speaker Jack With 8 Ohm Load (Figure 7) | L2 L3 L4 L6 | Maximum Indication on AC Level Meter. Maximum Sensitivity Indication on 12dB Sinadder Meter. In the Above Condition, Sensitivity is Flat for 136.00 ~ 174.00MHz and Sinad is Above 12dB at ~10dBuV (SSG Attenuator Level) |
| 2 | Level Meter Adjust Frequency:136.00 ~ 174.000 MHz MIC : Receive Function : None Volume : Adjust for 1V on the AC Level Meter Squelch : Turn to Counterclockwise SSG : Audio 1KHz Modulation 3KHz DEV Level 9dBuV | Connect Standard Signal Generator to EXT-ANT Connector. Connect AC Volt Level Meter, Distortion Meter Across EXT Speaker Jack With 8 Ohm Dummy Load (Figure 7) | RV1 | 9dBuV |

TROUBLESHOOTING

| Symptom | Cause and Remedy |
|-----------------------|---|
| Unit Will Not Turn On | <ul style="list-style-type: none"> • Broken/defective DC Power Cord • Blown fuse. Be sure you check for the cause. • Defective power switch. • Defective wires or poor soldering in power supply circuit. |
| No Sound Received: | <ul style="list-style-type: none"> • Defective External Jack • Defective RF circuit in receiver • Defective IF circuit IC IC1 • Defective audio power IC IC3 Check Voltage at pin 4 of IC3; if approximately 6V, problem is not with this IC • Defective Receiver power circuit Check Voltage Transistor (BRT) Q21 pin Nr4 If approximately 8V, problem is not with this circuit. • Squelch is "ON" all the time. If voltage at Base of Q1,Q5 is approx 0 Volt with Squelch Control is set to fully counterclockwise position, problem is not in with squelch circuit. Defective Q1, Q5 • Check whether the transceiver signal strength meter indicates S9 when a signal (146.520MHz carrier with 1KHz FM 3KHz Deviation, 1uV level) is supplied to antenna (The meter indication would be as following A and B) A) The meter indicates "S-9". You can assume that antenna through IF stage is OK. No Sound.... Check the integrated Voice signal circuit IC IC601 if pin7 of IC601 signal out, problem is not in with Voice signal circuit. B) No deflecting of meter. Checking should be made on RF stage Q12, D17, 4, Q6 and IF stage IC1, if not then, problem is in PLL circuit. Check frequency on collector of Q12 whether it is listed as in the table (Page 9, Alignment procedure, step1) • Defective Squelch circuit. • Defective PLL circuit. • Defective antenna connector. |
| No Noise | <ul style="list-style-type: none"> • Broken or bad contact in microphone connector or push-to-talk switch. • Defective RX power circuit. • Defective RX audio circuit. • Defective IF circuit. • Defective PLL circuit. • Defective squelch circuit |

| Symptom | Cause and Remedy |
|--------------------|---|
| No Transmission | <ul style="list-style-type: none"> • Broken or bad contact in microphone connector or push-to-talk switch. • Broken or bad contact in antenna connector. • Defect in PLL or Carrier Oscillator (Improper adjustment). • Check the frequency at collector of Q9. If no carrier, check Q11, D17, Q12 and X4. • Carrier is OK, but no TX; check the Vco voltage at TP (approx 2V), if not same as listed in VCO adjustment table figure 1, PLL circuit is defective. • Defect in power module circuit. • If above procedure working well. Check the carrier at collector of Q8, Q7, if no carrier, check Q8, Q7 and supply power circuit. |
| No Modulation | <ul style="list-style-type: none"> • Defective microphone. • Defective microphone connector. • Inoperative microphone amplifier. • Defective microphone amplifier IC IC601 <p>Check the voltage at pin 8 and Oscillation input at pin8 and audio input at pin 1 of IC601</p> <p>If audio signal out at pin 6 of IC601, then the CTCSS IC IC601 is OK</p> |
| No DTMF Modulation | <ul style="list-style-type: none"> • DTMF power switch off. • Defective DTMF power switch. • Defective DTMF IC IC301 <p>Check the voltage at pin 1 of IC301 (approx 5V).</p> <p>If signal out to pin 16 of IC601 when pressed DTMF key pad, then this IC is good.</p> <ul style="list-style-type: none"> • Improper position semi VR VR301. |
| No Scan | <ul style="list-style-type: none"> • Defective IC204 • Defective IC1 • Defective scan circuit: Check Q2, D3. |
| No LCD Display | <ul style="list-style-type: none"> • Defective IC204, LCD, 4.5MHz oscillator: <p>Check IC201, IC202, IC203.</p> |

Note : For remedy, replace or repair the defective circuits or component(s).